Software Adaptation to Serialization Formats using a WoT Semantic API

DataInstance Abstract Class

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Software Adaptation in WoT

For abstract interaction over diverse ecosystems, adaptation is needed for Transfer Layers, Serialization Formats, and Data Types

1. Adaptation to Transfer Layer formats is provided by Forms element processing
2. **DataInstance class library allows automatic adaptation to diverse serialization formats (OCF, LWM2M, SenML) by embedding a Data Item dictionary that contains Semantic Annotation**
3. Adaptation to Data Type and Scale + Units may be provided by a DataItem adaptation class

DataInstance Abstract Class

- DataInstance is a representation in some mediatype, which is also a transfer layer payload
- Described by a DataSchema
- Contains one or more DataItem as dataProperty
- Actions and Events exchange DataInstance representations
- Instance of an Interaction Property is an instance of DataInstance
- Interaction Property may also be a instance of a DataItem, providing get() and set() decorators

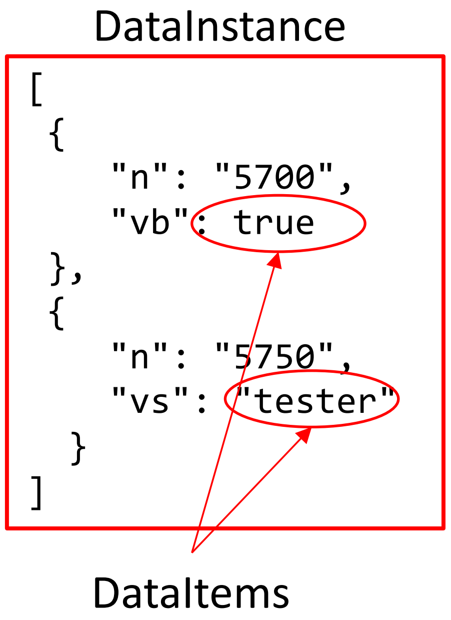
Semantic annotation and Schemas

- DataItems (variables) in DataInstance Schemas are identified by Semantic Annotation in "@type" values
- Schemas are used to validate and interpret incoming payloads
- Schemas are used to construct outgoing payloads
- Schema validator can be extended to emit a dictionary of DataItems that can be referenced using the Semantic Annotation
- Library can be used to create a Semantic API wrapper for the WoT Scripting API

DataInstance Dictionary

- Contains a JSON Pointer and sub-schema for each DataItem in a DataInstance
- Example for a SenML DataInstance

```
[
  {
    "path": "/0/vb",
    "@type": "iot:BinarySwitchData",
    "type": "boolean"
  },
  {
    "path": "/1/vs",
    "@type": "iot:ApplicationTypeData",
    "type": "string"
  }
]
```



```
[
 {
     "n": "5700",
     "vb": true
 },
 {
     "n": "5750",
     "vs": "tester"
  }
]
```

Semantic API Examples

```
// Semantic Lookup returns instances capable of semantic lookup
thing = local-directory.lookup-by-simple-template;
light = thing( {"@type": ["iot:Light", "BinarySwitchCapability"] } )
switch = light.property( {"@type": "iot:BinarySwitch"} )
rgbcolor = light.property( {"@type": "iot:RGBColor"} )
turnon = light.action( {"@type": "iot:TurnOnAction"} )
setlevel = light.action( {"@type": "iot:SetLevelAction"} )

// read() function with and without DataItem filter
>>> console.log( switch.read( {"@type": "iot:BinarySwitchData"} ))
true

>>> console.log( switch.read() )
[{ "@type": "iot:BinarySwitchData", "value": true },
  { "@type": "iot:ApplicationTypeData", "value": "tester" }]

// write() function
switch.write( {"@type": "iot:ApplicationTypeData", "value": "Light"} )
```

Semantic API Examples (2)

```
// Write of multiple DataItems in a structured DataInstance
rgbcolor.write( [
  {"@type": "iot:RedColorData", "value": 255},
  {"@type": "iot:GreenColorData", "value": 255},
  {"@type": "iot:BlueColorData", "value": 255} ] )

// invoke() function
turnon.invoke()

setlevel.invoke( [{"@type": "iot:LevelData", "value": 170},
{"@type": "iot:TransitionTimeData", "value": 100}] )

// chained semantic references
>>> console.log( thing({"@type": ["iot:Light","BinarySwitchCapability"]})
.property({"@type": "iot:BinarySwitch"})
.read({"@type": "iot:BinarySwitchData"}) )
true
```

Example Schema with Annotation

```
{
  "type": "array",
  "allOf": [
    {
      "contains": {
        "type": "object",
        "properties": {
          "n": {
            "type": "string",
            "const": "5700"
          },
          "vb": {
            "type": "boolean",
            "@type": "iot:SwitchData"
          }
        },
        "required": ["n", "vb"]
      }
    },
    {
      "contains": {
        "type": "object",
        "properties": {
          "n": {
            "type": "string",
            "const": "5750"
          },
          "vs": {
            "type": "string",
            "@type": "iot:ApplicationTypeData"
          }
        },
        "required": ["n", "vs"]
      }
    }
  ]
}
```